

complex these structures, the more convincing the evidence they furnish, since it then becomes so much the less probable that the same anatomical device should have been produced twice than that it should have been acquired once only. In the Artiodactyla, for example, "a definite case of an anatomical peculiarity, so well marked and complex as to be a safe guide to affinity," is seen in the elongation and spiral coiling of the proximal portion of the colon. The Perissodactyla and rodents supply other examples of evolution along a definite radius from the ancestral centre. From his investigations the author deduces inferences of importance for the general theory of evolution, especially as regards the limitation of the possible range of variation of organs in any set of animals which have once come to occupy a particular radius. Further changes and elaborations are then restricted by the past history, that is to say, by the limited material which it has furnished for further specialisation. In this way a simple explanation is given for the definite grooves, recognised by many writers, along which the specialisation of organisms must necessarily move, without having recourse to the assumption of any mysterious directive forces. E. A. M.

SCIENTIFIC REPORTS OF THE LOCAL GOVERNMENT BOARD.¹

THE first half of the volume under notice is devoted to the medical officer's report, statistical data, and details of various inspections and inquiries by the Board's inspectors. The second half contains reports of the auxiliary scientific investigations carried out for the Board. The first of these is a memorandum by Dr. Theodore Thomson on rats and ship-borne plague. The conclusion arrived at is that "the part played by the rat in transmission of plague to man, although real, falls far short of the importance which has generally been attributed to it." This may be true, but in view of the predominant part played by the rat in the dissemination of plague in the various Sydney epidemics, it is to be hoped that the campaign against this rodent will in no way be relaxed.

Bearing on the same subject, Drs. Haldane and Wade report on methods of rat destruction and disinfection on ship-board. In this especial attention is directed to the Clayton process, in which sulphur is burned at a high temperature, and air charged with the products of its combustion is pumped into the ship's hold. The gas is rapidly fatal to rats and other vermin, and is germicidal to non-sporing microbes, but it does not penetrate a loaded hold well, and has a deleterious action on certain articles. On the whole, however, it seems to be the best method to employ for rat destruction. Dr. Klein details further experiments on the two types, virulent human and less virulent rat, of the plague bacillus differentiated by him and described in a previous report. Dr. Klein also records some interesting observations on the influence of symbiosis on the virulence of microbes.

An important paper on the differentiation of various streptococci and staphylococci is contributed by Dr. M. H. Gordon. Hitherto the differences exhibited by the members of these classes of micro-organisms, particularly the streptococci, have been slight and indefinite, but by making use of culture media containing various mono-, di-, tri-, and poly-saccharides and glucosides, important differential characters are obtainable. Dr. Sidney Martin has continued his studies on the toxic action of microbes, dealing in the present volume with that of the *Proteus vulgaris*. The results, however, in this case are somewhat indefinite, the toxic reaction being mainly evinced by the development of agglutinin in the blood. Dr. Houston gives a detailed report of the bacteriological examination of normal human dejecta, and of the intestinal contents of sea-fowl and of fish. All gulls contained typical *B. coli* in their excrement in enormous numbers, but guillemots did not contain *B. coli* of any sort. As regards fish, those obtained "from a source seemingly above all suspicion of objectionable contamination, may contain sometimes apparently typical *B. coli* in their interior; in the great majority of

cases the results were either wholly negative or the microbes that were isolated proved to be atypical in character."

Dr. Alan Green contributes further observations on chloroformed calf vaccine which prove that the quality of the lymph prepared by this method is of a high order.

The above brief review shows that this report contains matter of the greatest interest and importance which should be studied by all bacteriologists and by those to whom the care of the public health is entrusted.

R. T. HEWLETT.

INFRA-RED SPECTRA.¹

THE record of an enormous amount of work on the absorption spectra of organic compounds and emission spectra of various metals and gases in the infra-red region is given in the volume under notice. The investigations were commenced whilst the author was a graduate student at Cornell University, and completed under the auspices of the Carnegie Institution of Washington.

Even to summarise the mass of valuable information contained would exceed the limits of our present space, but it may be said at once that, to workers along similar and related lines, these results, and the descriptions of the apparatus and methods whereby they were obtained, are indispensable.

Part i. occupies nearly seven-eighths of the whole volume, and deals with the absorption spectra of 131 organic compounds up to 15 μ . As is pointed out in the very complete historical review, all previous workers in this subject have abandoned the investigation at 7 μ for the alcohols and 10 μ for some few other compounds.

The description of the apparatus and methods is exhaustive and invaluable. From 0.8 μ to 2.5 μ a quartz prism was employed, beyond that, and up to 15 μ , one made of rock-salt. The source of the radiations was a Nernst lamp "heater," which gives a spectrum of which the energy curve is smooth and continuous. A reflecting spectrometer of 35 cm. focal length was employed for the explorations of the spectrum up to 15 μ , and a considerable portion of the work up to 7.5 μ was repeated with a spectrometer of 1 m. focal length.

The distribution of the energy in each spectrum was determined by means of a radiometer similar to that devised by Nicholls, but with some modifications.

The principal reasons for this investigation were the determination of the influence of molecular weight upon absorption spectra, and also the effect of molecular structure. The results show that in different compounds each of these causes in turn acts separately, whilst in other compounds the absorption is produced by the combined effect.

In recording the quartz-prism results the author deals separately with each absorption band in the nineteen compounds investigated, whilst in the other results the compounds are treated separately, notes being made of the chemical structure and properties of each substance where necessary.

Numerous tables set out the numerical results in various forms, whilst 140 full-page *transmission* curves show them graphically. In addition to these the author has written seven brief appendices dealing with side-issues in connection with the apparatus and the investigation and its results.

In part ii. Mr. Coblenz deals with the infra-red emission spectra of various metals, metallic chlorides (alkalies), and gases. The metals were employed as the poles for the arc producing the radiations, whilst the chlorides were volatilised on carbon arcs. The apparatus was very similar to that described in part i., except for a few modifications rendered necessary by the greater intensity and unsteadiness of the radiations.

With the metals, a black-body spectrum due to the oxides, and sufficiently strong to obliterate any emission lines which might be present, was found, and in the alkali chloride spectra no lines were discovered beyond 2 μ . Of the gases investigated—in vacuum tubes—N was found to be the only one having strong emission lines in its infra-red spectrum. CO₂, CO, and the vapour of C₂H₅HO were

¹ "Thirty-third Annual Report of the Local Government Board, 1903-4." Supplement containing the Report of the Medical Officer for 1903-4.

¹ "Investigations of Infra-Red Spectra." By William W. Coblenz. Pp. vi+331. (Washington, D.C.: The Carnegie Institution, 1905.)

found to exhibit a very strong emission band at 4.75μ . The emission spectrum of C_2H_5OH shows that a vapour in a vacuum tube can emit a continuous spectrum.

Ångström's conclusions—deduced from the fact that the total radiation *increases*, while the luminous radiation *decreases*, with increase of pressure in the gas—that there are two kinds of radiation present during the electrical discharge are found to be in close agreement with the observed facts. These different discharges were named "regular" and "irregular" (*i.e.* luminescence) by the previous observer. An interesting theoretical discussion of the action of pressure in this connection is given in the volume.

W. E. R.

DISEASES OF VINES.¹

TWO parts of the *Annales de l'Institut Central Ampélogique Royal Hongrois*, devoted to two of the vine diseases, have lately reached us.

In one of these parts (part iii.) an account is given of the little known disease caused by the attacks of *Phyllosticta Bizzozzeriana*. The disease was first noticed in the year 1900, and it has been kept under observation since then, with the result that its spread has been traced in some detail. The symptoms are somewhat similar to those of the dreaded "black-rot," but it does not appear as if it will prove so dangerous a parasite. In addition to a brief life-history of the fungus, illustrated by an excellent plate, a useful compendium of the species of *Phyllosticta* occurring on the vine is given.

Part iv. contains an unusually complete account of the "grey-rot" caused by *Botrytis cinerea*. This is one of the parasites of the vine which the cultivator most dreads. All aerial parts of the host-plant are attacked indiscriminately, and quickly become covered with a greyish or brown mould, which produces enormous quantities of ashy-grey spores. This stage is succeeded by the formation of small black sclerotia in the diseased tissues of the stems, leaves, and fruits. Naturally the fungus has been investigated time after time, but the researches of Istvanfi, published in this volume, have added a number of fresh facts to our knowledge of its life-history. In the first place, a series of laboratory investigations was made with the object of determining the conditions under which the fungus brought about the infection of the host-plant. The optimum temperature for the germination of the spores proved to be $25^\circ C.$, whilst the spores were killed by exposure to a temperature of $38^\circ C.$ to $41^\circ C.$ The effects of drying the spores were then investigated. One day's drying over sulphuric acid at laboratory temperatures, either in light or darkness, was sufficient to kill 75 per cent. of the spores, and desiccation for thirty-six days was fatal to all of them. Spores previously germinated and exposed to this treatment suffered still more severely. The results of freezing were again seriously to diminish their germinating capacity.

The action of a number of the commoner fungicides on spores was then examined, with interesting results. Thus a 1 per cent. solution of Bordeaux mixture only prevented the germination of some 60 per cent., and a 10 per cent. solution about 10 per cent. Spores which were allowed to dry after soaking in Bordeaux mixture all failed to germinate. Others sown in drops on the foliage of the host-plant not only germinated, but infected the tissues below them. On examining the action of the constituents of this mixture, lime water proved to be singularly efficacious in preventing germination.

In the majority of these experiments the spores of *Monilia* and of *Coniothyrium* were exposed to the same conditions, with results, on the whole, similar to those already quoted. At the same time, the life-history of the fungus was traced in detail. Istvanfi succeeded in germinating the sclerotia, and has settled the point once for all that they do give rise to the apothecia of *Sclerotinia fuckeliana*. So many observers have failed to obtain this ascigerous stage that it is well to have this definite statement. The sclerotia retain their germinating capacity for at least twenty-one months. Another interesting point

brought out in the course of this research is that the well known adpressoria of the fungus are the early stages in the development of the sclerotia. In addition to the microconidia observed by Brefeld and others, Istvanfi records the production of an oidial stage.

For further details, and for methods to be adopted for checking the spread of this pest, the original must be consulted. It is full of points of interest to the student of plant pathology, and makes one regret more and more that this country possesses no institute similar to the Central Ampélogique Royal Hongrois, where the pressing problems of plant disease can be adequately examined. Here we have to trust to the private individual for what investigations are made, and he all too rarely has opportunities to make them on the comprehensive scale possible at such an institution.

EARTHQUAKE ORIGINS.

AMONG the most interesting and important of the new ideas, which have been introduced into seismology, in late years, must be classed Major E. G. Harboe's notion of the nature of earthquake origins. Originally treated as a point, the focus of an earthquake has long been recognised as an area, but we are still in the habit of regarding it as restricted in size and small in comparison with the dimensions of the area over which the earthquake is felt. On this hypothesis the decrease in violence is correlated with increase in distance, and due to a gradual diminution of intensity as the disturbance travels from its origin; according to Major Harboe's conception, the focus of an earthquake is no longer restricted in size, but ramifies, with a varying degree of initial violence, over nearly the whole of the seismic area.

On the generally accepted hypothesis the coseismal lines should more or less correspond with the isoseismal, a decrease in violence being accompanied by an increase of time interval, but such is far from being the case, and we have been in the habit of attributing the irregularities to errors of observation; Major Harboe has now shown that another explanation is possible, and that the irregularities in recorded times almost disappear if his hypothesis of the nature of the origin is adopted. From the discussion of the records of earthquakes he reaches the conclusion that the true rate of propagation of the sensible shock is about 0.4 kilometre per second, the higher velocities obtained by other investigators being compounded of the rate of propagation of the disturbance along the origin, and that of the wave-motion set up by this disturbance.

This rate of propagation is that of the sensible shock, which can be felt by human beings, and not that of the large waves recorded by seismographs outside the seismic area proper; the latter, the rate of propagation of which is about 3 kilometres per second, are regarded as different in character, and propagated in the consolidated rock at some little depth below the surface, the sensible shock being due to quite superficial waves propagated through the more fissured and less coherent surface rocks.

One of the weightiest of the objections to this hypothesis was the value of 3.28 ± 0.05 km. sec. obtained by Profs. Sekiya and Omori in 1902 from the seismic triangulation started by Prof. Milne in 1884. This is dealt with in vol. viii., part iii., of Gerland's *Beiträge zur Geophysik*, where Major Harboe remarks that, in spite of the long period over which the observations extended, only four earthquakes seem to have given usable records from all the stations, three earthquakes at three stations, and one at two stations. Taking two of these earthquakes, for which records from a number of meteorological observatories have been published, he finds that the velocity and direction of propagation, deduced from the triangulation, lead to most discordant results at other stations, irregularities which disappear if a branch of the origin is supposed to have traversed the field of triangulation and the disturbance to have spread outwards to the stations.

Whether the hypothesis stands the test of future investigation or not, it seems to explain many previously inexplicable anomalies, apart from those of time. It appears to work out satisfactorily in the case of those earthquakes by which Major Harboe has attempted to test

¹ "Annales de l'Institut Central Ampélogique Royal Hongrois," tome iii., livre 3 and 4, 1905. (Budapest, 1905.)